

edies like bromoform, antipyrin, anti-tussin, etc. Occasionally I resort to belladonna, but not as a rule.

My practice is to tell the mother at once that she must not pin her whole faith to drugs, but that hygienic measures are of supreme importance. This means the child should be just as well nourished as possible all throughout the disease; that it should have pure, out-door air that is free from dust for 24 hours a day; that it should be in the sunshine as much as possible; and that it should avoid other children and violent exercises and causes of nerve irritation which incite paroxysms of coughing; and then, how to carry out in detail these measures, is carefully explained to her. The child is put through a careful lung examination at least every 5 days. If evidence of a deep bronchitis or bronchiolitis is discovered, it is put to bed and kept at rest in pure open air until danger of broncho-pneumonia has passed by. Proper treatment for capillary bronchitis means early treatment of the condition.

This means that we must see these patients often and watch carefully the general condition of the child as well as to know at all times the conditions in the respiratory tract. It is not sufficient care of the whooping-cough infant to give the mother a few general directions as to hygiene, and tell her that doctors and medicines can do no good, the disease must run its course; and let her go. In many cases, such a course will mean that later the doctor will be called in to treat a terminal pneumonia which might have been avoided had he been in close touch with the patient all along, and had known how the patient was standing the disease.

It is not my desire to recite in detail how to treat the paroxysm of cough, or how to care for the stomach of the child that loses all its food by vomiting. You all know these details. But let me urge the importance of great ventilation of the patient's sleeping-room, of the daily sunning and airing of the bedding, of the maintaining the patient's general condition all along at the highest possible point, by good food, fresh air and sunshine.

And finally, I urge more watchful care of these small patients with whooping-cough, and far greater activity in preventing them from being exposed to this severe infectious disease.

Intestinal Intoxication in Infants.*

By FLORENCE M. SYLVESTER, M. D., Oakland.

As one looks over the recent literature on intestinal intoxication in infants, one thing stands out prominently: the lack of harmony in the different theories advanced to find its cause. There is a great variety of causes suggested, and the inaccuracy of terms leads to many misunderstandings. From some few carefully observed phenomena general conclusions are arrived at, and on these are based entire systems of treatment. No sooner have we accepted an apparently well founded theory, but some one else will single out another symptom, and group about that a whole school of investigators, whose writings will upset all our notions about feeding for a time, until we settle down again with some new method. There surely is need for some practical clarification in the great mass of apparently contradictory data that are accumulating about the digestive disturbances of infants.

The most common intoxications are probably due to wrong feeding. For these satisfactory treatments have been evolved. As Czerny puts it: The problem of artificial feeding is solved for disturbances of alimentation, but not for those from infection or constitutional anomalies of absorption.

Secondly, we have intoxications due to bacterial action. From these we may eliminate for to-day's discussion the enteric infections, such as dysentery, cholera, typhoid, etc., whose main attack is local, and which have a definite symptom complex; also

the parenteral infections, such as grippe, pneumonia, etc., in which the intestinal disorder is entirely secondary.

That leaves for our consideration those bacterial intoxications, from absorption of products of decomposition, which are due to excessive putrefaction in the large intestine, the actual alimentary toxicoes. Herter¹ divides these into three distinct clinical types:

1. The indolic type, which shows us the marantic form of chronic indigestion in children with large abdomen, sweating of the head, and retarded physical growth. These children always show indican in the urine, due to the action of bacillus coli and bacillus putrificus. It is common in partial occlusion of the common bile duct or of the small intestine, and in functional pancreatic achylia. In the stools bacillus bifidus always dominates over the bacillus coli. This type has very great similarity with that of infantilism, which he describes more in detail in a later work, but no direct transition between the two has been observed.

2. The second, the saccharo butyric type, is much more common in adults, and leads to chronic invalidism. The bacillus aerogenes capsulatus is the most prominent organism; the stools are of light color, and have a definite odor of butyric acid. There is slow anemia, due to the hemolytic action of extract of the feces, and there is definite damage to the mucosa.

3. The third type is a combination of the two, in which anacrobates predominate, and there is persistent high indicanuria. These are the cases that show irritability, or mental depression, marked mental and muscular fatigue, and haemic disturbances. Peripheral neuritis, melancholia and other psychoses may be caused by enterogenic poisons. Probably there are also parenchymatous changes in liver and kidneys.

4. The most interesting of the conditions described by him is that of infantilism,² which is characterized by a retardation in the growth of the body, including the skeleton, with a relatively fair development of the brain.

These two points mentioned are the most important of the clinical features; associated with them we often find marked abdominal distention due to a partial paralysis of the gut, and without much flatus; a moderate anemia; a rapid onset of fatigue both mental and muscular, due to chronic intoxication, which allows the muscles to become weak and flabby, and usually some disturbance of intestinal function like diarrhea or fatty stools. There is often a sweating of the head, excessive appetite and thirst, associated with increase in urine, subnormal temperature, tendency to urticaria, marked nervous instability, sometimes even petitis mal, and occasionally rickets.

The characteristic feature in every case is the fact that the bacterial flora of the colon is the same as that of the nursing. Escherich calls it "Blaue Bacillose," as the Grampositive, blue rods predominate in the smear. They are mainly: bacillus bifidus, described by Tissier, productive of lactic acid; bacillus infantilis, which checks the growth and gas production of bacillus coli, and forms volatile bases, especially ammonia, and coccal forms. Bacillus coli and lactic aerogenes are very infrequent, but begin to appear with recovery.

The urine shows marked indicanuria, an excess of phenol in the distillate, aromatic oxyacids, the Diazo reaction, and indolacetic acid.

The intestinal contents show an abundance of fatty acid crystals. There are many phenolic substances, indol, hydrogen sulphid, indolacetic acid, and aromatic oxyacids, but skatol is never present. There is no calcium retention, and sometimes even a calcium loss; in one case the absorption was one-tenth as much as in a normal child. The fat loss is very evident in the marked increase in fatty acids and soaps. While the normal absorption of fat is from 92-98%, these cases fall as low as 85 or even

* Read before the Alameda County Medical Society, Oct. 17, 1911.

70%. Three-quarters of this is lost in the form of soaps, hence the fat loss is not due to lack of fat splitting, but to lack of absorption.

The pathological explanation of all these phenomena, and especially of the retarded development, is an insufficient absorption of foodstuffs from the intestinal tract. The carbohydrates, which are so important for the caloric needs and the deposit of adipose tissue, are not tolerated; the fats cause less disturbance, but they are not sufficiently utilized, for the loss may be 40% of the intake. Much of the calcium, important as "Bausteine" for tissue building, is lost as alkaline soaps. Besides this loss of foodstuffs, there is a constant state of intoxication due to the excessively rapid decomposition of dextrose by bacteria. This impaired power of absorption, in Herter's words, "is due to a chronic inflammatory process in the lower part of the small intestine and the contiguous part of the colon, due to a dominance of an unsuitable bacterial flora. The indol has a depressing or irritative action on the central nervous system, and this as well as all the other symptoms show a striking amelioration coincident with the fall of the aromatic putrefactive substances in the urine. The putrefaction not only entails the loss of food materials, but its products, after absorption, may have a damaging action on the cells concerned in assimilation.

If neglected, this condition would have as consequence deterioration and perhaps death, or at least a fixed state of underdevelopment. Under treatment there is marked improvement. In one case grand mal was the sequel to errors in diet in this condition, in an attempt to push the slow progress. The child had had, two years before, some seizures of petit mal, or at least losses of consciousness without motor symptoms. The appearance of epilepsy in this case was associated with an increase in intestinal putrefaction—that is, it followed intestinal intoxication in a child, whose nervous system had been rendered unstable by a long intoxication of milder intensity than that needed to induce grand mal.

Herter's claim that infantilism as well as some other forms of intestinal intoxication are due to "the dominance of an unsuitable bacterial flora" is based on his careful analysis of normal feces, at different ages, as compared with feces during nutritional disturbances. By means of cultures, but especially through the Gram stained field, he finds definite forms characteristic of certain conditions:

The meconium, which is a poor culture medium, has only spore-forming bacteria, and no bacillus lactis aerogenes, nor acidophilus.

The bottle-fed infant has more bacteria than the nursling, even if fed on sterilized milk; the feces show Gram negative bacteria of the bacillus coli type.

The nursling, on the contrary, shows mainly Gram positive bacteria of the bacillus bifidus type. Their stools have very little indol and skatol and no reaction with diamidoazobenzol.

In childhood bacillus putrificus and lactis aerogenes are only present in small number, but increased above the previous age, for the presence of bacillus coli and the neutral reaction favor the growth of the putrefactive anaerobes.

In the adult these two show a greater increase, and indican and ethereal sulphates appear in the urine.

In senescence bacillus coli is much decreased and bacillus putrificus flourishes—a condition which often may be causative of early senescence.

From the findings of such definite Gram positive rods in the nursling (which, however, in culture are easily overgrown by Gram negative colon bacteria), and, contrary to normal conditions, the persistence of this same Gram positive field in cases of infantilism (which, as recovery progresses, give way gradually to Gram negative fields, normal to the age of childhood, as well as to the bottle-fed babe, and

which reappears with recurrences), it is but one step to the assumption that this disease and the bacterial contents have some relation to each other. Herter assumes the persistence of the nursling's flora to be causative of infantilism.

But now, lest we think that all our pediatric troubles come from those ubiquitous bacteria, let us look at some of the theories attempting to explain the intolerance to certain foodstuffs in children by a perverted metabolism.

We are inclined to assume all nutritional disturbances due to a quantitative lack of response to definite factors in diet. To Finkelstein and his school, Meyer, Czerny and others, is due the emphasis now laid on the qualitative lack of response in a child with a constitutional metabolic disorder or "Ernaehrungstoerung."

In the beginning of our methods of percentage feeding most of our troubles were laid to the door of proteid intolerance. We based this on the appearance of so-called "curds" in the stools. Later these curds were eliminated by the wholesale and were all turned into lumps of fatty acids, soaps and bacteria by Meyer in Berlin, Leopold in New York and others of the Finkelstein school,³ with the assertion that casein was never found in them, and that even the hunger stools of infants not fed on proteid diet will give a protein reaction. It was Talbot of Boston⁴ who showed up the fact, which is so common in all these controversies, that there was a misunderstanding of terms. The "curds" of fat origin were small, soft, friable yellowish or whitish green,—and Talbot gives an excellent and simple method of determining in the stools the amount of fat excess as indicator for the variation of fat in the feeding. But the large, hard, tough curds, from the size of a pinhead to that of a lima bean are definitely distinct from the others.⁵ They do not disintegrate, they sink to the bottom in water, resemble horn or gelatine when dried, and finally crumble to powder. They are white, greenish or amber and are rare, never occurring in breast-fed infants. They disappear even in high protein mixtures if the milk is boiled, and occur only with raw casein, and more easily in fat free milk. Since in Germany boiled milk is used almost exclusively, and here the raw milk, the explanation is apparent why the German school claims that all "curds" are due to fat.

Dr. Porter in San Francisco has had an experience which bears out that principle. He found that these tough casein curds appeared at the same time in hospital infants fed on the same milk, which, on bacterial examination, showed at that time an unusually high count. They disappeared when the milk was boiled, or exchanged for clean milk. Hence the curds are caused by the feeding of bacterially contaminated milk. He suggests the explanation that by development of acidity a change in electrolytes is produced, which interferes with even the moderate protective action that lactalbumin usually exerts.

Although the Finkelstein school still claims that proteid is never causative of digestive disturbance, that casein is without danger in the most serious cases and even causes an alkaline fermentation, opposing the acid fermentation, yet the majority of authorities, at least in the United States, seem to think that protein in excess may cause nutritional disorders, though it is the least harmful of milk constituents.

The excess of fat in the stools can be approximately judged of by the Sudan 3 and carbol Fuchsin method as described by Talbot. It may show itself by the appearance of the "soft curd," mentioned above, flat, white flakes, often with mucus, green or yellow. Or more often there are typical soap stools, very light yellow or white, salve-like, or else dry and brittle, with a shiny surface. These are frequent in constipation from too much fat, and are often the precursor of diarrhea and infantile atrophy. The other type of fat stools, bright yellow, oily, soft, leaving a grease spot on paper, are easily recognized.

Czerny and Keller, also Heubner, emphasize the danger of excess of fat, maintaining that it is much less easily disposed of than proteid or carbohydrate excess.⁶ It remains in the intestine to be saponified, thereby extracting from the body alkaline bases, which are not compensated for by the milk diet. Our percentage methods have led to a great overfeeding with fat, and the skim milk feeding, that has recently become more and more popular, has eliminated a large number of disturbances due to this error. Sterilized, undiluted skim milk is digestible by premature infants, and in some especially difficult cases fat-free buttermilk has given excellent results. But both are too poor in nutritional elements for permanent food, and the skim milk in practice often leads to intractable constipation, theories to the contrary notwithstanding.

A factor that has been neglected because of its supposed harmlessness is the salt content of the infant's food, although it has been known for a long time that sodium chloride can have a toxic action. Ludwig and Meyer's investigations⁷ have thrown more light on this, and especially on its pyrogenic effects. At low concentration of sodium chloride solution only children with acute digestive disturbances react with increase of temperature; with a three per cent. solution all children react. This is due to the sodium itself, for the anion chlorine did not have the same effect, as little as did the other cations, calcium and potassium. The only other sodium salts increasing the temperature are sodium bromide and sodium iodide. The explanation of this phenomenon, that the halogen combinations with sodium are the most pyrogenic, is, according to Meyer, as follows: By their rapid absorption they pass rapidly through the mucosa into the blood, and inundate it with a hypertonic solution.

One reason why the effect of salts has been so long neglected is that an increased amount shows no definite symptoms unless the cells are directly damaged through too large doses, or other substances necessary for the cells are withdrawn through the salts. Then the symptoms are similar to those of alimentary disturbances from fat and carbohydrate: fever and changes in weight, but they are due mainly to the effect of salt on the water metabolism. A rapid binding of salt (or water) in the infant's organism leads to fever—a rapid giving off to subnormal temperature.

Just as a salt fever may follow an increased input of sodium chloride, so sugar may also cause a rise of temperature irrespective of digestive disturbances, from the physical effect of a hypertonic solution.⁹ The elevation of temperature in sugar fever occurs later than in salt fever, but the curve is about the same. This occurs more often in mixtures rich in whey, and varies according to the kind of sugar. Milk sugar and cane sugar are most likely to produce fever and diarrhea, dextrine-maltose mixtures are less likely to, and saccharose is the least noxious of them all. In regard to the sugar content of the blood,¹⁰ it is interesting to note, as Cobliner points out, that it is normally greater in nurslings than in adults. In dyspepsias and intoxications the blood sugar content is not increased, and in decomposition and putrefactive disturbances in the intestine there is a hypoglycemia, which gradually reaches the normal as the patient's condition improves. In salt fever there may be a hyperglycemia.

These terms dyspepsia, decomposition and intoxication are very frequent in the vocabulary of the Finkelstein school. Finkelstein assumes¹³ that certain types of metabolic disturbances, "Ernährungsstörungen," are based on a deterioration of the general physical condition and especially of the cells concerned in nutrition, so that the tolerance for food is diminished. In such conditions there is a morbid instead of the normal physiological reaction to food, a paradoxical reaction, which deviates from the normal in proportion as the food injury advances.

In this disorder he describes four definite types—hardly "stages," as some translators call them, for though sometimes they merge into each other, any

one of them may exist as a distinct condition in different cases.¹¹

The first and mildest of these is merely a disturbance of balance, "Bilanzstörung." The child does not gain on food that would cause normal growth in a healthy child; there is a paradoxical reaction to food. There is no definite loss of weight, no catastrophe—that comes later—but merely a lowering of tolerance to quantitative or qualitative increase in food, an inferior result of processes of nutrition due to this disturbed balance. In this condition there may be soap stools and a greater temperature variation, with the average slightly below or above normal, but above all a standstill in weight, a paradoxical reaction to food intake.

The cause of this is ascribed entirely to the fat. The proteid is innocent, the carbohydrate is still tolerated, though later that tolerance may decrease. Mother's milk always ameliorates the condition.

Dyspepsia shows more signs of local disturbance, akin to the condition usually called gastroenteritis. There is much fermentation and lowered resistance to bacterial action. An increase in fat causes not only a standstill, but a loss in weight, and carbohydrate intolerance is increased, hence a fat free, sugar poor buttermilk is successful in these cases. There may be more or less fever, according to the degree of sugar intolerance.

Alimentary decomposition shows signs of general disturbance. There is loss of weight on both fat and sugar in the food. The emaciation advances the more rapidly, the more food is supplied, as Finkelstein expresses it. There is a reversal of the processes of nutrition due to some mysterious change in the character of metabolism, a marked paradoxical reaction to food. These are the usual cases of atrophy and marasmus. Since there is such a marked narrowing of the field of tolerance, the food has to be cut down, which may improve the tolerance. But the low amount of food does not furnish the necessary energy quotient, and so there is loss of weight, whether the food be increased or decreased. Mother's milk may help in some cases, though later even that is not tolerated.

Alimentary intoxication is marked especially by fever, and may occur before any of the preceding conditions have been noticed, though it must have been preceded by some injury to the digestive tract, as in dyspepsia. In the fully developed cases there are always some of nine cardinal symptoms, and often all of them: Disturbances of consciousness, such as excitement, irritability, or sometimes stupor and even coma; changes in respiration, which is hastened and interrupted, often exaggerated and deepened; alimentary glycosuria; fever; collapse; diarrhea; albuminuria and cylindruria; loss of weight; and leucocytosis, usually not exceeding 30,000. This type in its varying degrees would cover the conditions of enterocolitis, acute enterocatatarrh, and cholera infantum.

The condition is the paradoxical reaction of a child with metabolic disorder to a constituent of the food which may possess capacity of toxic action and which is present in amounts exceeding the child's decreased tolerance. Even mother's milk here is no more tolerated.

The cause of the fever in these cases is always the sugar. This may produce, according to the degree of decomposition, either fermentation, or loss of weight, or fever, or fever and intoxication; and so the administration of varying amounts of sugar may be a diagnostic measure to determine the degree of decomposition. As soon as the sugar is eliminated from the diet, the phenomena of intoxication disappear. The role of fat is only indirect, by its injurious action on the sugar eliminating function. Less sugar can be worked up when fat is present than in fat-free food. So fat leads indirectly to intoxication, by making susceptibility to sugar intoxication greater.

The panacea for all these ills is found by Finkelstein in a temporary use of his albumen milk, which is made by separating the whey (which contains the

milk sugar and salts in solution) from the curd (which represent the casein and fat). This is done by repeated filtration under pressure through a linen cloth. Some water is added until the whole forms a milk-like, fine emulsion, then some buttermilk. The latter contains but little milk sugar, and the lactic acid has a good effect. The food is fabricated under uniform conditions by a German firm, and can be bought, thus avoiding the inaccuracies of individual production.

The averages are about 3% protein, 2.5% fat, 1.5% sugar, and 0.5% ash, as compared with the 3.5% fat, 4.5% sugar of cow's milk. The method of administration of albumen milk and the gradual transition to other foods are given in detail in Finkelstein's monograph, and the failure of some imitators of this feeding method may be due partly to nonobservance of some of these details, or to inaccurate diagnostic classification of the cases, so that Finkelstein's indications for definite doses were not observed.

From all these various and conflicting causes assigned to alimentary toxicoses, we can see that the treatment so far has to remain somewhat empirical and individualized.

For intoxications from bacterial infection Herter recommends above all high and repeated colon irrigations, avoidance of bacterial contamination of the food, as in uncooked foods and cheese, a non-irritating diet, rest and hygiene, use of a diastatic ferment, and avoidance of intestinal antiseptics and cathartics, but use of the various lactic acid containing milks.

Professor Koeppe, in Giessen, Germany,¹² has made some exhaustive study as to the use of buttermilk, and recommends highly a buttermilk soup, which is made in the following way, and which can also be had, systematically prepared by a German firm: Buttermilk won from sour cream, of a definite degree of acidity, is stirred with cane sugar and wheat flour over a fire until it comes to a boil three times. This buttermilk soup is called Hollaendische Sauglingsnahrung, or H. S. for short. Atrophic infants, who could thrive only on mother's milk, have gained on it, and one day old children can digest it. The cane sugar per cent. is high, but, contrary to all clinical experience, and especially contrary to the theories we have just seen, is well borne in H. S., which Koeppe explains by inversion of the cane sugar in boiling through the hydrogen ions of the acid milk and their further inverting action in the stomach so that no fermentation can occur. The high per cent. of albumen is well borne, because the curd is mechanically broken up into fine particles. There is also a chemical difference between the curd formation in sweet milk and buttermilk, since in the former the gastric hydrochloric acid has to remove the calcium, and the insoluble pure casein is the residue, which has to be acted upon by the pepsin, while in buttermilk this precipitation of casein acid is accomplished by lactic acid, and the HCl. of the stomach, not being needed to bind the calcium, can aid the pepsin to digest and disinfect.

I tried this preparation with good result in a babe which had persisted in constipation and frequent vomiting on skim milk, and which at two months weighed seven and a half pounds, as at birth. We used first the German market product, and later imitated the combination in the home, with good success, starting the babe on fair gain, until mother's milk could be secured for it.

As to the treatment of infantilism, Herter reports excellent results in the cases in which the management was based on his theory of causation. He emphasizes the need of general hygiene, both physical and mental; in the diet he avoids all opportunity for putrefaction. For carbohydrates he allows, definitely weighed, small amounts of rice, arrowroot, Huntley & Palmer biscuit, and dextrinized preparations—all this preferably given with a diastatic ferment. For proteid he relies mainly on milk, also egg albumen, and in older children occasionally minced beef or chicken. The yolk is badly tolerated. Above all, he recom-

mends the addition of gelatin to the diet, as it is exempt from ordinary fermentative decomposition, not having any tryptophan or tyrosin nucleus. It furnishes 4.3 calories per gram, and it is quite possible to give a child weighing 28 or 30 pounds one ounce in the twenty-four hours.

As to medication, he advises the giving of calcium and magnesium only in the soluble lactate form, and the phosphoric acid separate from the alkalies, to prevent precipitation of insoluble phosphates. Iron is not well tolerated.

From all this medley of facts and theories there is not much of which we can actually make practical use, but there are two points in Finkelstein's theory which cannot but appeal to the reader, and which other explanations of nutritional disorders have tended to omit: First, that we cannot expect from an infant with metabolic disturbances the same qualitative response to food as from a healthy child. The theory of a paradoxical reaction points at least to the probability that in such a child the processes of metabolism might be entirely different from those in a normal one.

Secondly, we cannot isolate the food elements and claim that any one alone is the disturbing factor. In the complex chemism of the body the different food elements interact upon each other. We see this in the relation of fat and sugar metabolism, of salts and water, of fat and alkali earths, and perhaps of many other constituents that have not yet been fully understood.

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COOPER COLLEGE SCIENCE CLUB.

The Cooper College Science Club held a regular meeting on Monday, Nov. 6th, 1911, in the medical Clinic of Cooper Medical College. The following scientific program was given:

1. Presentation of a Case of Contraction of Bandl's Ring Indicating Caesarian Section. Edmund Butler. Discussed by R. K. Smith.
2. Demonstration of Cases and Specimens. Harrington B. Graham. Discussed by Drs. Oliver, Graham, Eaves, Rixford, Addis.
3. Remarks on So-Called "Automobile Fractures," with X-Ray Pictures. W. H. Winterberg. Discussed by Drs. Rixford, Stillman, Rumwell, Winterberg.
4. Report of a Case of Malignant Oedema. James Eaves. Discussed by Drs. Stillman, Rixford, Ophuls, Oliver, Eloesser, Eaves.

Refreshments were served at the close of the program.